MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

VOL. XXXVIII. *May* 10, 1878. No. 7.

LORD LINDSAY, M.P., President, in the Chair.

Maxwell Hall, Esq., M.A., Jamaica; and

James L. McCance, Esq., Rathfern, Rayner's Road, Putney Hill;

were balloted for and duly elected Fellows of the Society.

On the Supposed Influence of a Mass of Brickwork upon the Errors of a Transit Instrument in its Neighbourhood. By John J. Plummer, M.A.

During a considerable portion of the years 1875–6 I was engaged in work that necessitated a strict watch upon the errors of the small transit instrument which serves as an adjunct to the Equatoreal of this Observatory for the determination of true time. It was my practice to find the level error upon each evening of observation, and to employ it in the reduction of that night's work; while the azimuth error was determined as often as was deemed necessary, or as circumstances permitted. The method employed for ascertaining the latter was generally the observation of a polar and a low southern star, and the errors adopted for the reductions are the means of two, three, or more such determinations. It was soon found that both errors, but particularly the azimuth, were very fairly steady for considerable intervals, notwithstanding that the stone piers which support the instrument rest on arches at a height of not less than 50 feet from the ground; in fact, but for this fortunate circumstance this mode of treatment would have been hardly admissible.

To economise space, in place of the actual individual results obtained, a list of the mean adopted errors of azimuth is here appended, together with the limiting dates of the period to which they are supposed to apply, and likewise the means of corresponding groups of errors of level.

Limiting Dates for each group.	Mean adopted Azimuthal Error.	No. of Determinations on which it depends.	Mean Level Error for the like period.	No. of Determinations on which it depends.
	″		″	
1875 Aug. 11—Aug. 12	− 1·82	1	+ 4·96	2
Aug. 14—Aug. 16	+ 1·84	2	+ 5·69	3
Aug. 20—Oct. 2	+ 0·26	3	− 3·49	12
Oct. 5—Oct. 22	+ 0·93	4	− 2·26	9
Nov. 8—Nov. 25	+ 4·58	3	+ 1·99	5
Dec. 7—Dec. 20	+ 5·62	2	+ 6·06	2
Dec. 22—Jan. 5	+ 7·83	3	+ 7·96	3
1876 Jan. 18—Jan. 22	(+ 9·80)	0	+ 7·89	2
Jan. 25—Feb. 11	+ 11·76	3	+ 6·14	6
Feb. 22—Feb. 24	+ 10·44	2	+ 5·85	3
Feb. 29—Mar. 10	+ 8·55	3	+ 4·00	5
Mar. 11—Mar. 29	+ 6·00	6	+ 0·44	10
Apr. 2—Apr. 8	+ 6·50	2	− 0·86	4
Apr. 21—Apr. 29	+ 3·30	3	− 3·43	5
May 1—May 9	+ 1·89	2	− 9·27	4
May 29—May 30	(− 0·06)	0	− 8·47	2
June 16—June 28	− 2·01	2	− 13·76	7
July 26—Aug. 2	− 5·81	1	− 3·50	2
Aug. 9—Aug. 17	− 1·00	4	− 4·59	6
Aug. 21	− 4·41	1	− 5·52	1
Aug. 25—Sept. 9	− 12·17	2	− 9·60	7
Sept. 14—Oct. 5	− 4·55	2	− 5·52	7
Oct. 7—Oct. 14	− 3·76	1	− 1·54	5
Nov. 7—Nov. 17	− 1·14	1	− 4·50	3

N.B. On June 27, the level error having become troublesomely large, the screws were altered in order to diminish it; but this alteration does not appear to have affected the azimuth error. After the alteration the level errors were more unsteady, and a month later the screws were tightened to ensure greater fixity to the instrument. This time, owing probably to the greater force used, the Y appears to have shifted in azimuth sensibly.

A casual inspection of the above azimuth errors is sufficient to indicate a marked and regular fluctuation, of which the maximum and minimum coincide closely with the periods of greatest cold and heat respectively, and for which no sufficient reason immediately suggests itself. It is to be remarked, however, that about 14 feet W.S.W. of the western pivot of the transit is situated the pier of the Equatoreal, which, with the wall surrounding it, forms an immense cylindrical mass of nearly solid brickwork 9 feet in diameter, built up from the ground. It follows, therefore, that

the conditions of radiation from the transit supports in this direction is materially different from that in every other, and that the temperature of the pier of the Equatoreal would not only change much more slowly than the surrounding walls of the transit-room, but would be subject to much less extreme degrees of heat and cold. This supposition is sufficient to explain the general tendency observed, although the magnitude of the variation is certainly greater than would have been expected. That this is the true explanation is strongly supported by the consideration of the less steady level errors, which are positive in the winter months and largely negative in the summer, precisely as would be the case if the explanation is correct, and moreover exhibit maxima and minima almost synchronising with the more trustworthy azimuthal results. As it must be conducive to accurate observation that all known causes of change of position of meridional instruments be eliminated, I have been induced to call attention to these results, in order that the surroundings of more important instruments may be made as symmetrical and homogeneous as possible.

Orwell Park Observatory,
1878, *March* 1.

List of Known Accordances between Cometary and Observed Meteor Showers. By Prof. A. S. Herschel.

This list of comet and meteor shower accordances supplies a key to the outline list presented two years ago in the Report of the Council of the Astronomical Society (vol. xxxvi., p. 220), in which the meteor showers, regarded as having close or distant affinities in the positions of their orbits to those of certain comets (enumerated in the list), were not, on account of the great length of such a table, particularly recorded and described. The former list contains a column (Column 9 in the present list) in which the degree of accuracy of the supposed accordance of each correlated meteoric shower, both in time and in position of the radiant-point, was represented by certain letters and accents, of which the use was explained in the introduction to the Table,* and they are here reproduced for identification of the meteor showers referred to in the list. But an additional column of the same nature is now supplied (No. 8 in this list), giving the same characters more accurately, and describing the accuracies of agreement of several new meteor showers which are noticed for

* A *a*, B′ *b*′ C″ *c*″ ? ; denote distances of 3, 6, 9, 12, 15, 18, and over 18 degrees (by the letters and sign of interrogation), and similar numbers of days (by the accents, comma, and semicolon), from exact accordance with a comet shower; parentheses being used to enclose them, thus (A), when the meteor shower, and brackets, thus [A], when the comet appulse is of longer duration than 6 days.

the first time as presenting resemblances either to the comets formerly enumerated or to some equally well attested ones of which the indications of pretty close coincidence have only recently been observed. The order of succession, and the total number of the accordances differs very little from those of the earlier list, and the consecutive numbers of that list (with those of a few similar comparisons published during the past few years in the Reports of the British Association) are given in the first and following columns of this Table.

The arrangement of the Table in its remaining columns and remarks calls for very little explanation; the representation of the cometary radiant-points, and of their Earth distances, at "Node" or "Appulse" (calculated by Dr. Weiss where W. is appended to them), having already been sufficiently elucidated in the above quoted introduction of the former list, and the times and positions, and authorities of the meteor radiant-points, with the letters and numbers that are used to denote them, being those which have been frequently described elsewhere by Mr. Greg in his published general Lists of Meteor Showers*. The single letter T. denotes showers in Captain Tupman's list†; Schm., showers in the list of radiant-points given by Dr. Schmidt in the *Astronomische Nachrichten*, No. 1756; D. observations by Mr. Denning; and C. by Mr. H. Corder. The letters T., S., W. following Mr. Denning's showers indicate positions of radiant-points which he has detected by reductions during the past year of the long lists of meteor-tracks—in Captain Tupman's Catalogue (T.), Schiaparelli's Catalogue of the Italian Luminous Meteor Association for the year 1872 (S.), and Dr. Weiss' Austrian Observations of Shooting Stars in the years 1867–74 (W.)—from which most of the new, and some of the closest and apparently most satisfactory accordances of the present list, have been derived.

* These *Notices*, vol. xxxii., p. 348. The initials G.H., H.N., S.Z. denote the catalogues of meteor showers derived from original observations by Greg and Herschel (*British Association Reports*, vol. for 1868), Heis and Neumayer (in the southern hemisphere, *Ibid.*), and Schiaparelli and Zezioli (in the German translation, by Dr. von Boguslawski, of Professor Schiaparelli's work on shooting stars).

† These *Notices*, vol. xxxiii., pp. 298–305, March 1873; here referred to as it was reprinted with some small subsequent alterations in the volume for 1874 of the *Reports of the British Association*, and in a pamphlet circulated by the British Association in that year, containing all the observations of meteor-tracks mapped and recorded by Captain Tupman in the Mediterranean during the years 1869–71.

Mon. Not. R.A.S., vol. xxxvi. p. 220.	Reference Nos. *Brit. Ass. Rep.* 1874, p. 350.	Reference Nos. *Brit. Ass. Rep.* 1875, p. 229.	Reference Nos. This List.	Reference Nos. Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (*a*).	Remarks, and Notes of more distant Agreements.
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(1)	(2) °	(3) °	(4)	(5)	(6)	(7) °	(8)	(9)	(10)
	3	1	1	...	Jan. 5	194	+24·5	1792 II ☌ (W.)	+0·07					
					Jan. 11, 12	183	+28	S.Z. 5	...	6	11·5	*b*,		
					Jan. 4–31	180	+35	T. 4	...	(0)	12·5	(C)		
					Jan. 1–25	183	+36	MG_1 (G.H.)	...	(0)	13	(C)		
			1*a*	...	Jan. 6	187	−22	1860 IV ☌	−0·045					
					Jan.–Feb.	188	−26	D.T.	...	(0)	4	[(*a*)	...	8↓ˢ; near β *Hydræ*.
	2	...	2	...	Jan. 20	128·5	−28·5	1840 I ☌ (W.)	−0·04					
					Jan. 5	145	−25	T. 7	...	15	16·5	*c*"		
					Jan.	145	−40	Δ_2 (H.N.)	...	(0)	20	(?)		
	15	...	3	(9)	Jan. 16	60	+40	1746 ʊ	(+0·07)					
					Jan. 28	67	+25	S.Z. 19	...	12	17	*c*'	?'	
					Dec. 20?–Feb. 6	65	+20	AG_1 (G.H.)	...	(0)	21	(?)	(?)	

Mon. Not. R.A.S., vol. xxxvi. p. 22.	Reference Nos. Brit. Ass. Rep. 1874, p. 350.	Brit. Ass. Rep. 1875, p. 229.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (*a*).	Remarks, and Notes of more distant Agreements.
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
a	...	...	4	...	Jan. 19	210	−15	1759 III Ω	(−0·05)					
					Feb. 8	231	−21	Do. (Perih.)	(−0·07)					
					Jan. 5, 11	210	− 6	T. 6	...	8	9	B′		
					Feb. 3–10	219	−23	T. 12	...	(0)	11·5	(*b*)	(B)	
					Feb. 17	218	−13			9	15+	*c*′		
					Jan.–Feb.	204	−10	D.T.	...	(0)	7·5	(B)	...	In *Libra*. 10 meteors.
					Jan.–Feb.	210	−13	D.	...	(0)	2	(A)	...	5 meteors (active in April at 203−8, 23 meteors).
			4*a*	(6*a*)	Jan. 20	256	+20	1672 ♉	+0·04	...	...	...	...	☄'s 1863 V ♉ and 1810 ♉ (Jan. 24, 29, 272+25, 277+21), are near these; and form with (6*a*, *see* the note) a remarkable ☄ group.
					Feb. 2	261	+23	1857 I ♉ (W.)	+0·03					
					Jan.–Feb.	251	+23	D.	...	(0)	5·5	(*a*)	...	11↓ˢ, in *Herc.* 1877; and confirmed by other observations.

2	...	34	5	...	Jan. 27	135	+25	1833 ʊ	(+0·04)				
					Feb. 12	144	+24	1833 ♉	−0·21				
					Jan. 1–Feb. 9 (max. Jan. 28–31)	135 to 140	+40	$M_{1,2}$ (G.H.)	...	(0)	16	(*c*)	(?)
					Jan. 31	134	+40	S.Z. 23	...	3	16	*c*	?
					Feb. 3	153	+21	S.Z. 26	...	7	14·5	C′	C
					Feb. 13	133	+26	S.Z. 32	...	1	10	*b*	B
	5	...	6	...	Jan. 29	208·5	−31	1718 ♌ (W.)	+0·04				
					Feb. 3–10	198	−22	T. 11	...	(5)	12	C,	
					Jan.–Feb.	213	−32	D.T.	...	(0)	3	(A)	...
3	6	...	6*a*	(4*a*)	Feb. 14	266	+ 9	1699 I ♉	+0·117				
					Feb. 13 ('69)	260	0	T. 16 (suspected)	...	1	10·5	*b*	*b*
4	7	2	7	...	Feb. 18	211	+ 9	1797 ♉	+0·27				
					Feb. 13	205	+ 4	T. 8	...	5	8	B,	B,
					Mar. 2, 3	209	+18	T. 22	...	12	9+	*b*′	

8 meteors, two showers (209−27 and 218−37).

♉ 1858 IV and 1799 II, Feb. 13–15, are close to this position, at 272+12, and 264+17. (*See* the note above, 4*a*.)

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(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
5	10	...	8	(10)	Feb. 23	285	− 8	1596 ☊	+1·4					
					Feb. 26	283	− 4·5	1845 III ☊	+0·06					
					Feb. 10 ('70)	290	−12	T. 14 (not act.)	...	13	7	B″	B″	[T. 28, Mar. 7, 270−22, is near. *See* No. 10.]
										16	10	*b*″		
1	15	...	9	(3)	Feb. 25	33	+33·5	1746 ☊	−0·03					
					Mar. 8	30	+28·5	1746 ☋	(−0·01)					
					Mar. 10	32	+31	1231 ☋	(+0·06)					
					Feb. 20–Mar. 1	33	+36	D.W.	...	(0)	3	(A)	...	10 meteors; active shower. A_5 (Heis, and G.H.), Mar. 1–15, (??) in list (*a*), are too distant.
					Feb.–Mar. 12	28	+35	D.S.	...	(0)	5	(*a*)	...	16 meteors, at β *Trianguli*.
7	11	...	10	(15)	Mar. 8	275	−38	1590 ☊	−0·30	...	...	...	...	1506 ☊, Feb. 6, +0·43, 266·5−37. 1877 I ☊, Mar. (15–) 27, −0·185, 273−40; Λ_1 (H.N.), April, 280−38. *See* 15.
				(8)	Mar. 7 ('70)	270	−22	T. 28 (after 3 A.M. only)	...	1	16	*c*	*c*	

6	8 / 9	3	1	...	Mar. 1	250·5	−12·5	1864 V ♂	+0·115				
					Mar. 16	249·5	+ 1	1862 IV ♂ (W.)	−0·013				
					Mar. 2–7	235	−15	T. 23	...	1	15	C	*c*,	2 close showers; bright on Mar. 7, '69.
					Mar. 3–25	247	− 3	SZ (G.H.)	...	(0)	9·5; 4	(*b*; *a*)		
					Mar. 7 ('70)	246	+ 0	T, 27	...	9	3·5	*a'*	C, *a'*	Suspected at 241 + 8, Mar. 7, 1869.
					Mar. 14, 15 ('69)	266	+ 6	T. 21	...	1	18	*c*	...	
					Mar. 2–7	246	+16	T. 19	...	9	17	*c'*	C'	2 close showers; bright on Mar. 7, '69.
9	13	5	12	(22)	Mar. 16	207	−48·5	1683 ♂ (W.)	+0·03					
					Mar.	192	−38	H_1 (H.N.)	...	(0)	14·5	(C)	(C)	
					Mar. 11–19 ('69)	203·5	−30·5	T. 17	...	(0)	16·5	(*c*)	(*c*)	2 close showers.
8	14	...	13	...	Mar. 18	312·5	+21·5	1763 ♂ (W.)	+0·02	...	...	...	...	♂ 1854 V, 1845 I, Feb. 13, 25, are nearer WZ, in position; ♂ 1580, 1784 II, Apr. 12, 26, have too great R.A.(335°); six comets in a group.
					Apr. 24	319	+19	1790 III ♂ (W.)	−0·06	...	...	...	...	
					Mar. 15–Apr. 20	305	+37	WZ (G.H.)	...	(0)	18	(*c*)	(*c*)	(Apr. 21, '72, 310 + 44; Denning).

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(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
10	12	4	14	...	Mar. 19	179	−26	1556 ♌	+0·20					
					Mar. 25	182·5	−28	1264 ♌	−0·02					
					Mar.	174	−30	Δ_1 (H.N.)	...	0	6·5	(B)	(B)	
			15	(10)	Mar. (15–)27	273	−40	1877 I ♌	−0·185	...	...	...	...	(*See* No. 10).
					Apr.	280	−38	Δ_1 (H.N.)	...	(4)	5·5	(a,)		
	10	...	16	(19)	Mar. 23	308	+12	961 ♉	+0·27					☌ 1763, 961, Mar. 18, 23, and 1857 V, 1825 I, Ap. 4, 9, are a close group about 308 + 15 (± 6°). *See* 19.
	17	...	...	...	Apr. 4	302	+11	1857 V ♉	−0·28					
					Mar. 1–19, Apr. 19–22	301·5	+12·5	Denning 1877	...	(4)	6·5	(B,)	...	14↓ˢ; observed in 1877.
										(16)	1·5	(A")	...	
					Apr. 1–22	304	+12	D.S.W.	...	(0)	2	(A)	...	15↓ˢ; reduced and observed in 1877.

11	16	...	17 (21)	Apr. 11	231·5	+27	1847 I ☌	−0·95	...	...	...	...	☿ visible in daytime. The agreement, suspected by Schiaparelli, is imperfect in perih. dist. Comp. No. 37.
				Apr. 13	231	+27	S.Z. 54	...	2	0·5	A	A	
				(Mar. 27–May 22)	234	+29	S.Z. (44, 48, 54, 65, 67, 70) aver.	...	(0)	4	(*a*)	A′ B″	6 showers, all quite close together (230 to 238, +24 to +36).
				Mar. 12–Apr. 30	223	+40	MG_2 (G.H.)	...	(0)	14·5	(C)	(*c*)	
				Apr. 11–30 ('73–'76)	241·5	+24·5	D.	...	(0)	9·5	(*b*)	(*b*)	13 meteors ('74–'76), '*Coronids*.'
				Apr. 12–June 30	235 to 240	+25	$Q_{1,2}$ (G.H.)	...	(1)	8·5	(B)	(B)	(Corrected pos., 1876–77, 235+25).
				Apr. 1–13	235	+25	D.S.	...	(0)	4·5	(*a*)	...	19 meteors, '*Coronids*.'
14	18	8	18	...	Apr. 15	116·5	−36	1830 I ☌	−0·08					
					Apr.	126	−42	Γ_4 (bis, H.N.)	...	(0)	10	(*b*)	(B)	
					Mar.	125	−38	Γ_4 (H.N.)						
12	...	...	19 (16) (23)		Mar. 26	296	+ 1·5	1743 II ☌	−0·30	...	...	...	...	(*See* 16). ☿ 1790 III, Apr. 24, is at 319+19. *See also* No. 23.
					Apr. 15	307	+ 4	1808 III ☌	−0·27					
					Mar. 25–Apr. 30	290	−10	OZ (G.H.)	...	(0)	12·5	(C)	(C)	
	19	7	20	...	Apr. 20	270·5	+32	1861 I ☌	+0·01					☿, 270·5+33·5 (Schiap.); 265+35 (Weiss?)
					Apr. 19–21	277	+34	QH_2 (G.H.)	...	0	6·5	B	...	The '*Lyrids*'; [their exact radiant-point perhaps uncertain (?)].
					Apr. 20, '69	267	+35	Karlinski	...	0	4·5	*a*		
					Apr. 20–22 '78	272	+32	D.	...	0	2	A	...	13 $\downarrow^s$ near the radiant-point.

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(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
	20	9	21	(17)	Apr. 22	255·5	+27·5	1748 II ☌	−0·11					
					Apr. 23	250	+40	S.Z. 60	...	1	14	C		
					Apr. 25	260	+24	S.Z. 63	...	3	6	*a*	...	Agrees fairly with the ☄ (Schiaparelli).
					Mar. 15–Apr. 23	268	+25	QH_1 (G.H.)	...	(0)	11	(*b*)		
					Apr. 1–13	255	+27	D.S.	...	9	0	A	...	9 meteors.
15	13	6	22	(9)	Apr. 23	203	−32·5	178 ☌	+0·22					
					Apr.	194	−30	H_2 (H.N.)	...	(0)	8	(B)	(B)	
12	...	...	23	(19)	Apr. 21	288·5	+ 5	1844 II ☌	−0·08					
13	17	10	...	...	May 1	296·5	+13·5	1853 II ☌	−0·07					
					Apr. 19–23	287	+22	D. 1872–78	...	0	17	*c*	...	A good centre; position observed and deduced from various catalogues.
					May 2 ('70)	285	+12	T. 34	....	11	8	B'	B'*b*	And Apr. 19–27, 286+5, 12 ↓[s] observed in 1877, and confirmed by other observations. (Denning.)
						298	+ 5	T. 35	...	1	8	B	*b*'B	

17	...	...	24	...	Apr. 12	215	−28	1737 I Ω	(−0·13)			
					May 8	235	−15	1737 I ♌	−0·48			
					May	223	−12	Schm.	...	(0)	12·5	(C)	(*c*)	(T. 32, Apr. 27–28, 230+5, is connected with later showers in higher Decl.)
					Mar. 20–May 29	227	− 5	SG_2 (G.H.)	...	(0)	13	(*b*)	(*b*)	
16	21	12	25	...	May 1	334·5	−16	837 I ♌	+0·03					
					May 4	337	0	1835 III ♉	(−0·06)	(Halley's Comet)				
					Apr. 30–May 2, 3	326	− 2·5	T. 33 ('70, 71)	...	0 1	15·5 11	*c* *b*	C *b*	Bright showers, especially April 29 1871, and May 2, 3, 1870.
18	22	11	26	...	June 10	273·5	+ 0·5	1618 III ♍	+0·10					
					June 10–13	273	− 3	D.S.	...	0	3·5	*a*	...	11 meteors, Ital. Cat. 1872.
					June	282	− 3	Schm.	...	(0)	9	(B)	(B)	
				(33)	June	266	−12	Schm.	...	(0)	14	(*c*)	(C)	Active also in July and August.
					June	269	−11	O_1 (H.N.)	...	(0)	12	(*b*)	(*b*)	
19	...	13	27	(28)	June 14	338	+57	1781 I ♍	−0·19					
					May 26–June 13	337	+59	D.S.	...	(1)	2	(A)	...	10 meteors, Ital. Cat. 1872.
					May 1–31	325	+55	B_1 (Heis)	...	(14)	7	(B″)		
					June	333	+42	B_2 (Heis)	...	(0)	16	(*c*)	(C)	

Mon. Not. R.A.S., vol. xxxvi. p. 220.	Reference Nos. Brit. Ass. Rep. 1874, p. 350.	Brit. Ass. Rep. 1875, p. 229.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (a).	Remarks, and Notes of more distant Agreements.
(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
20	23	14	28	(27)	June 24	312·5	+60·5	1850 I ☌ (W.)	+0·065					
					May 26–June 13	312	+63	D.S.	...	(11)	2·5	(A')	...	5 meteors, Ital. Cat. 1872.
					June 11–July 11	315	+60	B_1 (G.H.)	...	(0)	1·5	(A)	(A)	
					July 1–15, 16–31	315	+54	B_3 (Heis)	...	(7)	7	(B')	(B')	
						320	+70	B_4 (Heis)	...	(21)	10	(*b*;)		
					July 8	288	+64	S.Z. 89	...	14	11	*b*''		
					July 13	338	+65	S.Z. 94	...	19	12·5	C;		
			29	...	June 20	8	+ 5	1864 II ♉	(0·00)					
21	24	15	...	...	June 27	12	+ 6	1864 II ☌	−0·05					
					July	7	+ 4	Schm.	...	(4)	5·5	(*a*,)	(A)	[And Aug., 3 + 1.]
					July	18	0	Schm.	...	(4)	8·5	(B,)	(B)	
					July	0	+17	Schm.	...	(4)	16·5	(*c*,)	(C)	[And July, 20 − 11; (4^d), 19°, (?,).]
22	...	...	30	(31)	June 25	348·5	+28	1822 IV ☌	+0·14					
					July	345	+25	Schm.	...	(5)	4·5	(*a*,)	(*b* C)	
					July 18	342	+23	S.Z. 100	...	24	7	B;	B''*b*	

23	...	...	31	(30)	June 30	342	+14	1822 III ☌	+0·11					
					July 13	349	+12	1770 II ☌	−0·09					
					June 1–13	343	+16	D.S.	...	(17)	2	(A")	...	8 meteors, Ital. Cat. 1872.
					June	335	+10	Schm.	...	(0)	8	(B)	(*b*)	And July 5–28, 335+7; (5[d]), 10°, (*b*,). 20–31, 334+1; (20), 15, (*c*;).
					June 28	338	+13	T. 38	...	2	4	*a*	*a*	And July 1–6, 337+1; 1[d], 14°·5, C.
					June 29–Aug. 24	330–45	+14	T_1 (G.H.)	...	(0)	(0)	(A)	(*a*)	'*Pegasids.*'
27	...	18	32	(35)	July 8	39	+45	770 ☌	+0·20					
					June 1–13	35	+47	D. S.	...	(25)	3	(A;)		6 meteors. Ital. Cat. 1872.
					July 6–20	36	+47	D. 1877	...	(0)	3	(A)		6 meteors, not *Perseïds.*
24	27	16	33	...	July 8	276	−21·5	1770 I ☋	(+0·02)	...	...	...	...	Until ☋, Nov. 29, 257·5−21 (−0·025). Lexell's Comet.
					Aug. 6	283	−20	1770 I ☌	−0·22					
					June 29–July 6	283	−13	T. 36	...	(2)	10·5	(*b*)	*b*	Average of 3 close radiants.
				(26)	July (& Aug.)	266	−12	Schm.	...	(0)	13	(C)		
					July 18–Aug. 31	285	−25	Schm.	...	(0)	5	(*a*)	(*a*, *b*, *b*)	Average of 3 close radiants. And Sept., 282−22; (0[d]), 5°, (*a*).
25	28	...	34	...	July 29	175	+71	1737 II ☌ (W.)	−0·025					
					End of July	165	+62	Schm.	...	(0)	10·5	(*b*)	(*b*)	Confirmed by Schiap. (S.Z. 118), and by G. & H. (V) more distantly.

Mon. Not. R.A.S., vol. xxxvi. p. 220.	Reference Nos. Brit. Ass. Rep. 1874, p. 350.	Brit. Ass. Rep. 1875, p. 229.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (a).	Remarks, and Notes of more distant Agreements.
(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
26	25	17	35	...	July 23	262·5	−33	568 ☊	(−0·01)					
					Aug. 5	259	−36	568 ☋	−0·06					
					July	258	−20	O_2 } Neum.	...	(0)	13	(C)	(C)	Fireball, July 25, '76, England, 258−24 (near Antares).
					Aug.	250	−35	Λ_5 }	...	(0)	7·5	(B)	(B)	
					Aug.	266	−42	Schm.	...	(0)	8	(B)	(*b*)	And July, 245−30, (0^d) 17°, (*c*,).
27	30	18	...	...	July 25	49	+45·5	1764 ☋	−0·11					
			36	(32)	Aug. 10	43	+57·5	1862 III ☋	+0·02					
					Aug. 12	43·5	+53	1870 I ☋	+0·03					
					July 12–20	47	+45	D. 1877	...	(5)	2	A,		5 ↓ⁿ, leaving streaks, not *Perseïds*.
					Aug. 7–12 (10, max.)	44	+56	...	...	0	1·5	A	A	'*Perseïds*.'
28	29	...	37	...	Aug. 12	299	+80	1853 III ☋ (W.)	−0·69					Large ☄, visible in daytime.
					July 24–Aug. 11	315	+87	S.Z. 115, 135, 143	...	(1)	7	(B)	B, A′ *b*	Average of 3 close radiants. Agreement in perih. dist. is imperfect.
					July 16–Aug. 31	315	+84·5	$N_{12,13,14}$, (Heis)	...	(0)	6	(*b*)	(B)	Average of 3 close radiants. The agreement, supposed by Weiss, is doubted by Schiaparelli.
					July 28–Sept. 10	359	+89	$N_{12,13}$ (G.H.)	...	(0)	10	(*b*)	(B)	
					Aug. 10,11, 22	270	+83	T. 52	...	(0)	5	(*a*)	*a′ c*	Average of 3 radiants observed by Denza and Tupman.

			38	...	Aug. 9	32	−18·5	1877 II ♌	+0·30				
					Aug. 1–12	26	− 6	Schm.	...	(o)	14	(C)	
29	31	19	38*a*	(39)	Aug. 10	40·5	−13·5	1852 II ♌ (W.)	+ ·013				
				(42)	Aug. 11	48	− 8	1827 II ♌	−0·16				
35	32	...	...	...	Aug. 26	65	−22	1558 ♌ (W.)	−0 11				
					Aug.	55	−18	Schm.	...	(o)	10	(*b*)	(*c*)
30	33	21	39	(38*a*)	Aug. 7	41	+11·5	1862 II ♉	(−0·025)				
					Aug. 19	47·5	+13	1862 II ♍ (W.)	+0·03				
34	...	...	...	...	Aug. 22*	57	+21	1864 II ♉	+0·03				
					Aug. 10	47	+18	S.Z. 140	...	[o]	6·5	[B]	B
					Aug. 10	48	+19	Denza (T. 48)	...	[o]	8	[B]	B
					Aug. 11 & 12	41·5 / 46·5	+24	Weiss (T. 48)	...	[o]	12	[C]	*b* Two close radiants.
					Aug. 4, 22, 28	40	+30	T. 48	...	[o]	18	[(?)]	... Average of 3 radiants.
					Aug. 3–15	55	+26	RG_1 (G.H.)	...	[o]	17·5	[*c*]	*c*
					Aug. 3–12	55	+ 7	Schm.	...	[o]	12·5	[C]	(C*c*)
				(42)	Aug.	53	+ 1	Schm.	...	[o]	14	[(C)]	(C*b*)
					Aug. 20-25	53	+ 1	T. 65	...	[o]	14	[C]	(C) *b'*
					Sept. 3–30	51	+14	Schm.	...	(12)	9	(B″)	

* The date and apparent place (Sept. 2, 57 + 1) of this cometary radiant-point was given erroneously in former lists.

Reference Nos.					Shower-date. or Duration (1875).	Position of Radiant-point (1875).		Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); +without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in		Accuracy of Agreement, by Symbol used in		Remarks, and Notes of more distant Agreements.
Mon. Not. R.A.S., vol. xxxvi. p. 220.	*Brit. Ass. Rep.* 1874, p. 350.	*Brit. Ass. Rep.* 1875, p. 229.	This List.	Comp. No. in this List.		R.A.	N. Decl.			Days.	Degrees.	This List.	List (*a*).	
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
31	34	22	40	...	Aug. 14	3·5	+38·5	1780 II ♒	−0·18					
					July 28–Sept. 3	1 to 15	+36	$P_{1,2}$ (G.H.)	...	(0)	2·5	(A)	(*a*)	July 26–Au. 11, '73, 2+27, Den. July–Aug. '76, 6+27, Den. } (*b*) Aug. 2–11 '76, 10+42, Den. (B)
					July 27, Aug. 23	7, 0	+32, 33	T. 45	...	18, 9	7·5, 6	B″′	B″′	[July 30, 345+40, S.Z. 135; 15ᵈ, 13°, C″C′. Aug. 2, 340+42, Hind, '75; 12ᵈ, 18°, *c*′C′. July 16–Aug. 16, 340+42, Den. '76; (0ᵈ), 19°, (?).]
					Aug. 8–13	2	+29	Denza (T. 45, 51, 62)	...	1	9·5	*b*	*b*	
					Aug. 1–31	11	+30	Schm.	...	(0)	11	(*b*)	(*b*)	
32	35	...	41	...	Aug. 16	89	+ 6	1808 II ♌	+0·07					
		23	...	...	Aug. 23	92·5	0	1797 ♌	−0·0)					
					Aug 29 '70	(78	+23)	T. 72	...	13	20	?″	?″	Subradiant (?) of a bright shower seen on Sept. 8–10, 1869 (T. 72).
					Aug. 31	85	−15	T. 67	...	8	17	*c*′	*c*′	
33	31	19	42	(38*a*)	Aug. 27	49	− 9	1596 ♌	−0·25					
33	...	20	...	(43)	Aug. 31	47·5	− 6	1845 III ♌	−0·36					

33	...	24	...	(44)	Sept. 10	53	−16	1854 IV ☊ (W.)	+0·02				
				(39)	Aug.	53	+ 1	Schm.	...	(0)	10	(*b*)	(C)
					Aug. 20-25	53	+ 1	T. 65	...	2	11	*b*	C,
				(44)	Sept.	55	− 6	Schm.	...	(0)	8	(B)	(B)
					Sept. 3–27	66	−22	Schm.	...	(0)	15	(C)	
	37	...	42*a*	(53)	Sept. 8	100	+59	1858 VI ☌ (Donati's)	−0·29	...	...	...	...
					Aug., Sep., Oct.	101	+57	D. T.S. &c.	...	(0)	2	(A)	...
					Sept. 1–15	99	+57	D. S.	...	(0)	2	(A)	...
37*a*	...	...	43	...	Sept. 20	44·5	−24	1763 ☊ (W.)	−0·03				
				(42)	Sept.	40	− 8	Schm.	...	(0)	16·5	(*c*)	(*c*?)
35	36	24	44	(42)	Sept. 26–27	62	−13	961 ☊ and ☋	−0·03 (−0·04)				
					Sept. 13–15	65	+ 6	T. 75	...	[0]	19+	[?]	?
					& sub-radt.	68	− 5	T. 76	...	[0]	10+	[*b*]	*b*
				(42)	Sept. 3–27	66	−22	Schm.	...	(0)	10	(*b*)	(B*a*)

	Greg, 95 + 54, Aug.; and A.S.H. 87 + 50, Sept. 27; see also No. 53.
	40 meteors, from Tupman, Lucas, Italian, and other observations.
	33 meteors in Italian observations.
	And Sept., 33−6, Schm., = (?).
	Average of three close showers; pretty bright; 1869.

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(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
36	39	26	45	(55)	Sept. 19	17·5	+18	1769 ☄	+0·78					
					Sept. 28	24·5	+17·5	1769 V	(−0·02)					
					Sept. (1–10)	17	+ 9	Schm.	...	(9)	3	(A′)	(A′)	
						21	+18				11	(b′)	(B′)	
					Sept. 17–Oct. 21	15	+11	D. 1876	...	(0)	11	(b)	...	(*Piscids* I) at δ, η *Piscium* (see No. 55).
37	38	25	46	...	Sept. 19	145	+49·5	1683 ☄	+0·175					
					Sept. 30	172·5	+68	1840 III ☄	−0·15					
					Sept.	142	+67	Schm.	...	(0)	18	(c)	(c)	
											11	(b)	(b)	
38	40	27	47	(52)	Oct. 4	54	+52·5	1847 VI ☄	−0·265					
					Oct. 1–15	51	+61	A_{15} (Heis)	...	(0)	9	(B)	(B)	The last of Heis' *Perseo-Cassiopeiads*, A_{12-15}, Aug. 16–Oct. 31, all close to this.

39	...	...	48	...	Oct. 9	112·5	− 7	1723 ♌	+0·065					
					Oct.	115	−10	Schm.	...	(0)	4	(*a*)	(*a*)	
					Oct. 11, 16	107, 1	− 2·5 ,0	T. 87	...	2	7	B	B	Two close positions.
					Oct. 14	110	+ 6	T. 82	...	5	13	C,	(*c*)	
	...	...	49	...	Oct. 7	134	+77	1825 II ♋	−0·115					
					Oct. 1–15	105	+81	N_{17} (Heis)	...	(0)	7	(B)	(B)	$N_{15\text{-}18}$ (Sept. and Oct.) are all sensibly at this place.
					Sept. 20–Oct. 29	161	+84	D.	...	0	(8)	(B)	...	Observed 1876.
41	...	...	50	...	Oct. 16	61	− 7	1580 ♌	+0·18	...	...	...	...	Schm., 18–27 Oct., 87−2, is too distant; and Ψ (H.N.), Oct., 50−4, (*b*), which is compared with it by Schmidt, appears to be distinct,—(*c*) in list (*a*).
					Oct. 5, 6	54	−14	T. 78	...	10	8	B'	*a'*	
					Oct. 12, 13	76·5	−10	T. 76 (2 pos.)	...	3	17·5	*c*	C	
43	41	28	51	...	Oct. 19	39	−29·5	1779 ♌ (W.)	−0·02					
					Oct.	40	−30	Schm.	...	(0)	1	(A)	(A)	And Oct. 19–27, 34−14, (0^d), 17°, (*c*).

Mon. Not. R.A.S., vol. xxxvi. p. 220.	Reference Nos. Brit. Ass. Rep. 1874, p. 330.	Brit. Ass. Rep. 1875, p. 229.	This List.	Comp. No. in this List.	Shower date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (a).	Remarks, and Notes of more distant Agreements.
(a)	(b)	(c)	(d)	(e)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
42	...	...	52	...	Oct. 19	2	+54	1850 II ☄	−0·22					
					Oct. 22–28	5	+53	Schm.	...	(0)	2	(A)	A	Heis, B_{10}, and Schm. for end of Oct., at 337 + 57 (close average), (*Cc*).
				(47)	Oct.–Nov. 8	15	+52	D. (*Cassiopeiads*)	...	(0)	8	(B)	...	20 meteors, 1876, confirmed by reductions of Hung. obs. of 1872; Corder gives Oct., 22 + 58 ((0ª), 10°, (*b*)), '76.
41	42	29	53	(42*a*)	Oct. 21	81	+57	1842 II ☄	−0·14	...	...	...	...	[Dble. *Aurigid* ('76) rad. cont., Den., Nov. 22–Dec. 14, } 80 + 42 & 80 + 50, } = F_3; *see* No. 59].
					Oct. 25	78	+60	1848 I ☄	−0·23					
					Sept. 28	83	+54	S.Z. 153						
					Oct. 14–25	90	+58	D.	...	(0)	4·5	(*a*)	...	Obsd. 1876, { & Nov.–Dec. 8, 69 + 66. *'Aurigids'*; { Schm., Nov., 66 + 65.
				(59)	Sept. 17–Nov. 24	83–92	+50–55	$F_{1,2}$ (G.H.)	...	(0)	7	(B)	(B)	Other showers referred to these comets in the R.A.S. list, 1876, are here assigned to another comet (*see* No. 59).
					Oct. 15, 16	86	+45	T. 92	...	5	13	C,	C,	

45	43	30	54	(61)	Oct. 22	157	+39	1739 ♂	+0·08	(*Leonid* sub-shower)		Schm., Oct., 140+23, (o[a]), 20°,(?); and Corder, Nov. 9, 146+33, 17[d], 10°, *b*" (Den. Nov. 20–Dec. 13, 155+36, *see* below, No. 65).
					Oct. 3–20	142	+44	LG (G.H.)	...	(2)	11·5	(*b*)	(*c*)	
				(65)	Nov. 7	160	+40	T. 97 (estimd.)	...	15	2	A"	A"	
46	...	...	55	(45)	Oct. 8	19·5	+19	1757 ♉	(+0·08)	...	...	...	...	*Piscids*, renewed from No. 45, and continued in No. 68.
				(68)	Oct. 29	30	+26	,, ♂	−0·33					
					Oct. 17	24	+26·5	Gruber I	...	(o)	[4]	[*a*]	...	Gruber's Oct. Rads. V, VII, X, XIII, XIV are all near this comet-shower.
					Oct. 19–27	33	+21	Schm.	...	(o)	[6]	[*a*]	(*a*)	
					Nov. 3	30	+22	T. 94	...	5	4	*a*,	*a*,	
					Nov. 9–10	23	+10	C. 1876	...	...	...	...	...	(And 12+33) 5 ↓[s] each, Corder, '76. These and Heis P, Oct. 16–31, 23+40, (*c*) are doubtful accordances with the ♂ ♂.
47	...	...	56	...	Oct. 14	278	+53	1857 IV ♂	−0·26					
					Nov. 1	318	+53	1695 ♌	−0·12					
					Sept. 17–Oct. 25	317	+57	D. 1876	...	(8)	4	(*a'*)	...	Average of 2 feeble showers, 1876; and 10 *Cygnids* in Aust. Obs., Oct. 19, at 300+55.
					Nov. 1–13	282	+57	Schm.	...	(18)	4·5	(*a*;)	...	And Heis D, Nov. 1–15, 279+56.
						307	+53			(o)	6	(*a*)	(*a*)	
					Nov. 7–25	299	+50	D. 1876	...	(6)	10	(*b*,)	...	Corder, Nov. 10, 334+40, not clear; and Nov. 16–17, 310+60, 2 or 3 ↓[s] 1876. (Continued in Jan. 1877 at 295+53, 20 ↓[s], Denning.)

Mon. Not. R.A.S., vol. xxxvi. p. 220*	Reference Nos. Brit. Ass. Rep. 1874. p. 350.	Brit. Ass. Rep. 1875, p. 229.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☿'s Node (or Appulse); +without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement by Symbol used in This List.	Accuracy of Agreement by Symbol used in List (a).	Remarks, and Notes of more distant Agreements.
(a)	(b)	(c)	(d)	(e)	(1)	(2) °	(3) °	(4)	(5)	(6)	(7) °	(8)	(9)	(10)
			57	...	Oct. 16	209·5	+42·5	1864 IV ☌ (W.)	+0·045					
					Nov. 1	205	+48	1097 ☌	−0·06					
					Nov. 13–Dec. 10	201	+44	D.W.S.	...	...	...	...	...	8 ↓[s] Aust. & Ital. Obs. 1872.
					Nov. 21–Dec. 20	208	+43	D.	...	...	...	...	...	17 ↓[s] observed 1876.
48	...	...	58	...	Nov. 4	104·5	+27	837 I ☌	+0·34					
					Oct. 20–26, 1839	99	+26	Herrick	...	9	5	a'		
					Oct. 22–27	109·5	+25·2	Gruber IX		8	5	a'		
					Oct. 21–25, max. 23 (A.M.), '68	111	+29	S.Z. 161 (a fine shower)	...	12	6	b''	B,	And T. 90, Oct. 12, 105+24, 23[d], 3°, =A; S.Z. 169, 172, Nov. 12, 17, close together at 117·5+38·5, 10[d], 15°=c'; and T. 82, Nov. 7, 101+7 =? are far positions. '*Gemellids*.'
					Oct. 18–27	108	+12	Schm.	...	(8)	16	(c')	(c')	
					Nov.	113	+14			(0)	16·5	(c)	(c)	
					Oct. 25–Nov. 23	110	+23	D. 1876	...	...	...	...	...	12 ↓[s] '*Gemellids*'; distinct from '*Geminids*,' Nov. 21–Dec. 21, at 107+33.
					Nov. 16–17	106	+23	C. 1876	...	...	...	...	...	2 good ↓[s] and two or three others.

49)	44	...	59	(53)	Nov. 9	89	+36	1582 (??) 8	0·0(?)				
44					Oct. 16–31	72	+44	A_{16} Heis	...	(9)	14	(C')	(C)	
					Oct. 19–Nov. 10	71	+43	D. 1876	...	(0)	16	(*c*)	...	And Nov. 22–30, 79+21. 5 meteors. 1876, Den. 85+33, 5 meteors. *See* No. 60 (Den.); with separate show. Oct. 14–25, at 90+58 (No. 53).
44	...	...	...	...	Oct. 24	77	+45	S.Z. 162	...	16	12·5	C''	(B')	
					Nov. 10	87	+47	S.Z. 166	...	1	11	*b*		
44	...	...	...	...	Oct. 10–27	71	+31	Schm.	...	(13)	16	(*c'*)	(*b'*)	Double *Aurigid* rad. Nov. 22–Dec. 14, at 80+42 and 80+50 D., 1876; *see* No. 53.
					Nov.(10–14?)	82	+45		...	(0)	11·5	(*b*)		
					Nov. 7–17	75	+45	C. 1876	...	(0)	17	(*c*)	...	General rad., with a special position, at 86+36, of large meteors, on Nov. 7, 9, 10, 1876.
					Nov. 7–10	86	+36			0	2·5	A	...	
49	44	...	60	...	Nov. 11	86	+19·5	1821 8	+0·03					
					Oct. 17–Nov. 13	90	+15	O (G.H.)	...	(0)	5·5	(*a*)	(*a*)	= T. 79 (Oct. 5-17); Gruber II. VIII, Oct. 17–24; S.Z. 156, 7?, 8, 160, Oct. 13–21; '*Orionids*,' max. Oct. 18 20.
					Oct. 10–27	79	+13	Schm.	...	(15)	9	(*b''*)	...	Schm., Nov., 79+5, (o^d). 16°. (*c*); T. 99, Nov. 10–11, 77+10, 8^d, 11°, C'=C; S.Z. 165, Nov. 10, 70+20, 1^d, 14°·5, C=*c*.
					Oct. 18–27	93	+17			(15)	7	(B'')	...	
				(64)	Nov. 2?–Dec. 8	80	+23	D. 1876	...	11	6+	(B')	...	20 ↓* confirmed by Greg; also by Aust. observations, Dec. 7–13, at 83+23; ('*Taurids II*,' *see* No. 64).

Mon. Not. R.A.S., vol. xxxvi. p. 220.	Reference Nos. *Brit. Ass. Rep.* 1874. p. 350.	*Brit. Ass. Rep.* 1875. p. 239.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☄'s Node (or Appulse); +without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement by Symbol used in This List.	Accuracy of Agreement by Symbol used in List (*a*)	Remarks, and Notes of more distant Agreements.
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
	45	31	61	(54)	Nov. 13	150·5	+23·5	1866 I ☌	−0·015					
				(65)	Nov. 13–14, 1866–67	149	+23	*Omnes*	...	0	1·5	A	A,	The '*Leonids*'; generally observed; chiefly on Nov. 15, A.M., after 1871.
					Nov. 19–20, 1876	149	+22	D. 1876	...	7	2	A′	...	5 ↓ˢ, evidently *Leonids*.
50	...	...	62	...	Nov. 24	147	0	1813 I ☌	−0·30					
					Nov. 25–Dec. 21	148	+ 2	D. 1876	...	(1)	2·5	(A)	...	11 ↓ˢ, principally on Nov. 26–29 (*Max.*) at 153−1.
				(71)	Oct. 31–Dec. 12	134	+ 6	I.H (G.H.)	...	(0)	14·5	(C)	...	And Schm., Dec., 146+16, (7^{d}), 16° = (*c*′). *See* No. 71.
	46	32	63	...	Nov. 28, '52	23·4	+43	1852 III ☌ (W) (Biela's comet)	0·005					
					Nov. 27, '66	25·2	+42		(Hind)					
					Dec. 6, 1847	25	+40	Heis	...	8	3·5	*a*′	...	At Aix-la-Chapelle (*die Periodische Sternschnuppen*, 1849).
					Nov. 30, 1867	17	+48	S.Z. 176	...	3	6·5	B	...	9 ↓ˢ (Zezioli) with good radiant-point.
					Nov. 27, 1872	25	+43	*Omnes*	...	1·	1·5	A.	...	The '*Andromedes*'; generally observed; and also (?) on Nov. 24, 1872.
					Nov. 16–17, 1876	24	+43	D.	...	...	...	...	...	6 ↓ˢ; indistinct shower.

50*a*	...	...	64	...	Nov. 27	56	+20	1702 U	−0·07	...	...	...	...	Schm. {Oct., 50+2. {Oct. 10–22, 62+6. Den., Oct. 21–29, 1876, 61+18.
					Oct. 25–Nov. 21	64	+18	RG_2 (G.H.)	...	(8)	5·5	(*a'*)	(A; A"B')	The '*Taurids* I' of November; = T. 91, Nov. 7–12, 51+13·5, 56+21; = Heis, R_4, Nov. 14, 55+16; = D., Nov. 8, 58+16, and 20 (A.M.), 62+22·5 (and 65+12); = C., Nov. 16, 58+28, 63+9; and = Backh., Nov. 5, 54+16.
					(Nov. 21, '65	56	+13	Detonating fireball, Engl.						
					Nov. 23, '77	62	+21	Great ditto ditto)						
					Nov. 28–Dec. 24	57	+25	D. (*Taurids* III)	...	(1)	8	(B)	...	AG_1, Dec.–Feb., at same place as *Taurids* I = '*Taurids* III.'
				(60)	Nov. 10	70	+20	S.Z. 165	...	19	12·5	C;	...	(S.Z. 157, Oct. 21, 75+25, *see* 60.)
					Nov. 22–Dec. 14	79	+24	D., & C., 1876	...	(0)	22	?	...	'*Taurids* II.' A new shower, with max. on Dec. 6, 1876, at 80+23; Denning; *see* No. 60.
51	47	...	65	(54)	Dec. 2	162	+34·5	1798 II *v3*	−0·14					
				(51)	Nov. 26–Dec. 13	155	+36	D. 1876	...	3	5·5	...	...	Chiefly Nov. 26–29, a good max. (21 $\downarrow^s$, and 5 besides); Aust. reductions Nov. 13–Dec. 13, 160+32, 10 $\downarrow^s$; continued in Ital. and other obs. in Jan., Feb., and March.
					Dec. 9	154	+26	S.Z. 182	...	7	10	*b'*	*b'*	S.Z. 177, 178, 186, *cc'* C;, Nov. 30–Dec. 23, are also near. T. 97, Nov. 7, (B;), is far off in date.
					Dec. 5–14	163	+32	C. 1876	...	...	...	...	...	Doubtful (sub-rad. of *Ursa-Lyncids*).

Mon. Not. R.A.S., vol. XXXVI. p. 220.	Reference Nos. *Brit. Ass. Rep.* 1874, p. 350.	Reference Nos. *Brit. Ass. Rep.* 1875, p. 229.	This List.	Comp. No. in this List.	Shower-date, or Duration (1875).	Position of Radiant-point (1875). R.A.	Position of Radiant-point (1875). N. Decl.	Comet's Node, or Appulse (Ω). Authorities and Designations of the Meteor Showers.	Earth-distance of ☿'s Node (or Appulse); + without (or North of) ⊕'s Orbit.	Discordance of Date and Position of Meteor Radiant-point in Days.	Discordance of Date and Position of Meteor Radiant-point in Degrees.	Accuracy of Agreement, by Symbol used in This List.	Accuracy of Agreement, by Symbol used in List (*a*).	Remarks, and Notes of more distant Agreements.
(*a*)	(*b*)	(*c*)	(*d*)	(*e*)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
						°	°				°			
			66	...	Dec. 3	359	+53	1818 I (?) ☿	−0·20					
					Nov.–Dec.	342	+62	D. 1876	...	(0)	12+	(C)	...	14 ↓ˢ, confirmed by 5 Ital. & Aust. ↓ˢ Dec. 7–13, at 333+59. '*Cepheïds*.'
52	49	...	67	...	Dec. 6	200	+68·5	1812 ☿ (Pons')	−0·23	...	...	(B) *c*, ?"	(C) *c*, ?"	Schm., Nov., 180+65; S.Z. 183, 187, Dec. 12, 23, *c c*. KG (G.H.), Nov.–Dec., 160+71, = (C).
					Dec.–Jan.	209	+67	D. 1876–77	...	(0)	3½	(*a*)	...	19 ↓ˢ; 9 Aust. ↓ˢ, Dec. 7–13 = 200+67; and 21 Ital. ↓ˢ, Jan. = 205+67.
					Nov. 25–Dec. 14	210	+67	C. 1876	...	0	4	(*a*)		
54	48	33	68	(55)	Nov. 13	21	+ 4	1743 I Ω	(−0·025)	(13)	8	(B″)	...	Schm., Oct., 27−1.
					Dec. 21	11	− 2·5	„ ☿	−0·14	(4)	10	(*b*,)	...	Den., Oct. 19–Nov. 9, 20+14, max. Oct. 21, feebly continued to Dec. 8, 1876.

				(Feb. 7	353	− 8	„ Ω	+0·025)	(3)	6+	(B,)	...	Corder, Nov. 9–10, 23 + 10, 5 ↓*, 1876.
				Oct. 18–Nov. 10	23	+ 8	150 (Greg, 1875)	...	(3)	4·5	(*a*)	...	At *o Piscium*, 25 + 8, Oct. 30, 1872; T. W. Backhouse.
				Dec.	4	+ 4	Schmidt	...	...	...	(*b*)	(*b*)	
		69	...	Dec. 12–17	200·5	+ 4·5	1846 VII ♂	+0·09					
				Dec.–Jan.	207	+ 5	D. 1876	...	(0)	6·5	(B)	...	10 swift ↓*; feebly confirmed by Austrian observations.
53	49	...	70	...	Dec. 20	221	+77	1858 I = 1790 II (Mechain's) ♂	+0·075	(5)	19	?,	?,	Heis, N_{20}, Dec. 1–15, 123 + 78.
					Dec. or Jan.?	240	+70	D. 1877	...	(12)	8·5	(B')	...	12 small meteors; strongly confirmed by Italian observations.
55	50	...	71	(54)	Dec. 26	132	+21·5	1680 ♂ (W.)	−0·05	17	16	*c*"	*c*"	S.Z. 181, 135 + 37, Dec. 9.
										(0)	15·5	(*c*)	...	Schm., Dec., 146 + 16, and Dec.–Jan., 117 + 13 (two showers at 120 + 10, and 115 + 15).
										(0)	17	(*c*)	...	
				(62)	Dec. 21–Jan. 5	130	+20	D. 1876-7	...	(0)	2·5	(A)	...	Feeble shower at δ *Cancri*, confirmed by other observations.
					Dec.	130	+30	Schm.	...	(0)	9+	(*b*)	(*b*)	Corder, Dec. 1876, 131 + 34.
					Dec. 12. '67	136	+30	Masters	...	14	10	*b*"	*b*"	A well-marked shower.

The April Lyrids, and contemporary Meteor Showers.
By W. F. Denning, Esq.

The return of these meteors was slightly observed this year on the evenings of April 20, 21, and 22, the two preceding nights having been overcast. On the 20th a watch was sustained between $8^h\ 45^m$ and $10^h\ 5^m$, with a very cloudy condition of sky, and only 7 meteors were seen, of which 3 were *Lyrids* and 3 belonged to a radiant near ϵ *Herculis*. On the 21st and 22nd the sky was very clear, and two hours' watching each night, between $10^h\ 30^m$ and $12^h\ 30^m$, revealed 25 (6 *Lyrids*) and 22 (3 *Lyrids*) meteors respectively. The motions were very slow; only 2 were as bright as first magnitude stars. The *Lyrids* were trained, and nearly all of them foreshortened close to a radiant, very exactly defined at $272°+32°$. Of the other visible showers the most prominent were at $293°+43°$ (δ *Cygni*) and $263°+62°$ (ξ *Draconis*), and several additional ones in *Quadrans*, *Cygnus*, and *Corona* were very slightly seen.

My recent observations of this shower show the radiant to be almost identical with Comet I., 1861, with which a connection has been inferred. Former observations, including my own, place the centre a few degrees N.E. of the cometary radiant at $270°+32°$, and the agreement of the two this year is an interesting point. In 1873–4 I had noticed the absolute inaction of this radiant on April 21, whereas this year it certainly continued on that and the following night. There were no traces of it on the 25th.

Whilst writing on the subject of the April shooting stars, I may mention that I lately undertook the careful examination of many thousands of paths (recorded by various observers in the morning hours of April 19–23), with the idea of finding the chief showers eastwards of the *Lyrids*, and situated in *Cygnus*, *Lyra*, *Vulpecula*, *Draco*, &c. I selected nearly 300 meteors with a length and direction of path conforming to such radiants, and having plotted them upon star-charts, the centres of 18 showers were found as under:—

Meteor-radiants eastward of the Lyrids, April 19–23.

Radiant ☌ ☌	No. of ↓s	Radiant ☌ ☌	No. of ↓s	Radiant ☌ ☌	No. of ↓s
*280+58	22	*314+49	13	*321+31	8
*294+41	25	*311+37	15	*292+14	7
*287+22	20	308+31	7	*275+11	7
*316+61	16	307+40	8	302+18	6
*284+44	11	*309+68	15	*332+42	5
*312+22	13	296+53	9	281+28	5

* Exact, and probably certain.

The majority of these are new showers. Amongst the catalogues which I consulted (chiefly Dr. Weiss's collection of Austrian observations, 1867–1874, which contain a very large number for April) there were many short paths and several stationary meteors. It is not surprising that these showers have nearly all of them escaped detection hitherto. They are samples of feeble, long enduring systems with a stationary radiant, and it must be remembered that reductions of this kind have never been undertaken before from such a mass of different materials, which in fact have only recently been published. The durations from April 19 to 23 are of course merely provisional, and I am convinced that a person would get the same radiants from meteors recorded during short periods before and after the dates mentioned. The first shower in the table is already well known as the *Draconids* (No. 64, at 281°+57°, of Mr. Greg's Catalogue, 1876). Of the remainder the next three showers, each giving a sharply defined active radiant, are the best, and appear to be new. I believe they may all be relied upon, and will be verified in time. The one at 294°+41° (slightly preceding δ *Cygni*) I have already confirmed from my own observations this year.

In April there are also many radiants (at present quite unknown) in *Perseus*, *Auriga*, *Cassiopeia*, and bordering constellations, but it is obviously desirable that, inasmuch as the subject is becoming very wide and confused, only the most active and certain showers should be mentioned. Amongst these are positions at 106°+46°, 91°+58°, 80°+74°, 53°+70°, 40°+73°, 130°+79°, indicated by about 10–15 meteors each. Strongly suspected radiants lie at δ *Cassiopeia*, η *Persei*, *p-q* and *c* (Bode) *Camelopardi*, β *Geminorum*, &c. This region needs more watching in April.

Ashley Down, Bristol,
May 8, 1878.

Observations of the Transit of Mercury, 1878, *May* 6, *made at the Royal Observatory, Greenwich.*

(*Communicated by the Astronomer Royal.*)

In addition to the instruments belonging to the Royal Observatory, the equatoreals and detached telescopes returned from the Transit of *Venus* expeditions were mounted in preparation for the Transit of *Mercury*. There were thus 14 instruments, of apertures ranging from 12·8 in. to 2·8 in., available, to each of which an observer was assigned; but the Sun was completely hidden by cloud throughout the whole transit, with the exception of a short break about 10^m after internal contact, and the following are the only observations which appear worth recording:—

Great Equatoreal: Aperture 12·8 inches.
Observer: W. H. M. Christie.

The planet was only seen from about $3^h\ 25^m$ to $3^h\ 40^m$ G.M.T., more or less through cloud, though the definition at first was very fine. It was examined with five different powers.

No. 2,	Negative, with neutral tint wedge	126
No. 2,	Negative, with solar diagonal and neutral tint wedge	205
Supplementary A,	Negative, with polarising solar eye-piece (three reflexions) with and without neutral tint wedge	198
Supplementary A,	Negative, with solar diagonal and polarising solar eye-piece	320
No. III.,	Positive, with direct-vision polarising eye-piece with and without a diaphragm, giving a field of about three times diameter of *Mercury*	133

The solar diagonal was provided with a Barlow lens, so as to lengthen the focus.

1. A minute bright spot was seen with all these eye-pieces very near the centre of the planet's disk. It was slightly diffused, but with a brilliant starlike nucleus. As far as I could judge, it did not shift its relative position with the place of *Mercury* in the field of view, but I did not test this for extreme positions, being occupied with the scrutiny of the planet and its neighbourhood during the short time available. In the course of the observations, however, the position of the planet in the field of view was changed repeatedly. The bright spot was only seen when the eye-piece was carefully adjusted to focus, and the definition good as tested by the distinctness of the "rice grains" on the Sun. The spot was central, as nearly as I could estimate; if anything it appeared slightly on the side away from the point of contact, but I could not make sure of this.

2. A bright halo of somewhat irregular outline, and having a breadth of 3″ to 4″ was seen round the planet with an inner and much brighter ring about 1″ in breadth. The halo was much brighter than the ordinary surface of the Sun. It may have been an effect of contrast. It was best seen when the light was reduced to extreme faintness by turning the Nicol of the direct-vision solar eye-piece. The inner and brighter ring was only seen with this eye-piece. No effect on it or on the bright spot seemed to be produced by the diaphragm limiting the field of view to about 40″, but clouds obscured the Sun before I could do much with the diaphragm.

Simms' Equatoreal, No. II.: Aperture 6 inches.
Observer: E. Dunkin.

At the time of external and internal contacts the sky near the Sun was densely cloudy. A few minutes after internal contact,

about 3^h 25^m M.T., a break in the clouds, which had been gradually coming up from the S.W., reached the Sun, and from that time till about 3^h 42^m M.T., *Mercury* was generally visible on the Sun, and occasionally seen free from cloud. A negative eye-piece, giving a power of 150, was used, with a solar diagonal and neutral tint wedge.

When first observed *Mercury* had advanced some distance from the Sun's limb, but was still partly obscured by clouds. These gradually cleared away, when both the Sun and planet were seen superbly defined; in fact, I can scarcely remember seeing a better definition of the granular surface of the Sun. *Mercury* was intensely black, except that I saw distinctly, for about a quarter of a minute, a very minute point of light near the centre, a little towards the following limb of the planet. There could, I think, be no doubt of this phenomenon, though the spot was not continuously visible during my examination. After an interval of two minutes the point of light became more vividly distinct than before. The passing clouds, becoming denser, prevented any further observations.

During the few minutes of superb definition, the ring, or corona of light, noticed around *Mercury* at the transit in 1868, was clearly visible, its breadth being about one-third that of the planet. To my eye, this corona was evidently fainter than the Sun, and appeared with radiating arms as in the solar corona. Looking at the intensely black disk of *Mercury*, in conjunction with the bright surface of the Sun, the halo of light seemed to be of a half-tint, and my impression at the time was that this ring of apparently subdued light was probably produced only by contrast. The halo was perfectly uniform around the planet. I had prepared to examine both the corona and the luminous point on *Mercury* with various powers, but before I could re-focus the instrument, using a higher power, the clouds became too dense to continue the observations.

Equatoreal by T. Cooke: Aperture 6 inches.
Observer: Captain G. L. Tupman.

After the ingress the Sun was almost, if not entirely, free from clouds for fifteen or twenty minutes, although never free from a thin white haze. The definition was not nearly so good as it had been during the week previous. There was a good deal of "boiling." I scrutinised the planet most diligently with powers of 110, 140, and 240, with and without the solar diagonal, using when necessary an achromatised wedge of bluish neutral tint glass. I could not detect the slightest trace of a permanent white spot within the disk. Occasionally there was a faint white diffused light over parts of the planet's disk, but it was not permanent, appeared in different parts, and sometimes on both sides of the centre.

I could not detect any ring, either luminous or shadowy,

surrounding the planet. I was struck with the extreme sharpness of the planet's outline.

I was prepared to take measures with the double-image micrometer, but the planet was too far on when first seen to measure its position, and the clouds generally made such observations impossible.

Hodgson Refractor: Aperture 6 inches.
Observer: G. S. Criswick.

The Sun at the time of ingress was completely hidden by clouds, and did not become visible till the planet was well advanced on the Sun's disk. I then noticed that *Mercury* appeared to be surrounded by a ring of light equal in breadth to about two-thirds of the diameter of the planet, irregularly defined, rather fainter and whiter than the light of the Sun. As I continued to watch the planet, this ring seemed sensibly to contract in breadth, and to completely disappear as the image of the Sun became less bright from passing clouds. Two bright spots were also seen on *Mercury*, one, the fainter, nearly, but not quite, in the centre of the black disk, a little to the right or eastward; the other, and brighter, being nearer to the upper limb. These spots were not always visible to me, and I thought that they appeared sometimes slightly to shift their position with respect to the disk of the planet, but not *inter se*.

I am inclined to think that the ring of light seen round the planet was, as it appeared to me, merely the effect of contrast, as it was not visible during the later half of the time that the Sun was visible.

With regard to the two bright spots, except that they were certainly there, the shortness of the time available, and the more or less cloud about, prevented my having any opinion.

After the clouds had so obscured the Sun that it was impossible to say whether it was in the field or not, *Mercury* was most distinctly visible.

The telescope used was the "Hodgson," with a solar diagonal eye-piece, and a power of 180.

Sheepshanks' Equatoreal: 6·7 in. Aperture. Power 70, Negative Eye-piece. *Observer*: A. W. Downing.

The planet was not seen till quite on the Sun. An appearance of a ring slightly brighter than the Sun was visible round the planet, but no bright spot could be seen with this eye-piece.

Tried a negative eye-piece of power 140, and the existence of a spot was *suspected*, but the definition was not good with this power. The sky was more or less cloudy all the time, and a careful examination could not be made.

Simms' Equatoreal, No. II., and Lee Equatoreal: Aperture 6 inches.
Observer: W. G. Thackeray.

Neither the Sun nor *Mercury* was visible, on account of the clouds, till about ten minutes after the time of ingress. On looking at *Mercury* through the telescope used by Mr. Dunkin it had a uniformly dark appearance, but after a minute or two I saw a confused patch of light in the middle of the planet, which appeared to vary in size and brightness according as the Sun was more or less obscured by clouds, and left me under the impression that the light was due to contrast. I afterwards looked through the telescope used by Captain Browne (Lee Equatoreal); *Mercury* then appeared of a uniformly dark colour, but by this time the clouds had become much thicker, and the Sun's limb was very faint. When the Sun was no longer visible *Mercury* could be seen in the telescope, and then the centre appeared the darkest.

Detached Telescope, Simms No. I.: Aperture 6 inches.
Observer: W. C. Nash.

No observations made at ingress. Sky cloudy.

About $3^h\ 28^m$ *Mercury* was seen on the Sun's disk, and for a time afterwards.

With telescope, Simms No. I., using powers 145 and 240, I carefully examined the planet, but could detect no signs of a ring surrounding it, or of a bright spot upon its disk.

Later on, I examined *Mercury* under favourable circumstances with the Lee Equatoreal, but could not detect a bright spot.

With the photoheliograph three photographs were obtained by Mr. Maunder on wet plates, which seem to show some traces of a bright halo round *Mercury*. A number of dry plates had been prepared by the tea process, but there was no opportunity for exposing them.

Royal Observatory, Greenwich,
1878, *May* 8.

Other Observations of the Transit of Mercury, May 6, 1878.

Mr. Brett writes:—

"A part of the transit was observed by me, and by Mr. Walter Pye, and by my assistant observer, at my Observatory near Putney.

"The contacts were hidden by an impenetrable mist.

"The planet was first seen after it had passed within the Sun's

limb a distance nearly equal to its own diameter; and from that time until $3^h\ 45^m$ G.M.T. it was frequently seen at intervals through a film of cloud more or less dense, but which served very well the purpose of a dark glass.

"The planet appeared as a black disk surrounded by a ring of bright light. When the clouds thickened of course both were hidden, but the black disk never for a moment appeared without the ring of bright light.

"My impression at the first appearance was that the width of the ring was equal to a third of the diameter of the black disk. I immediately expressed that as my opinion, and it was echoed by Mr. Walter Pye, who was observing with another telescope, but he added that at the first appearance it was not round; and he afterwards explained that the bright ring was not concentric with the black disk; the ring being narrower on the side next the Sun's limb. When the next break in the clouds occurred this eccentricity was not seen. We continued to have good views of the planet and the ring during half an hour, definition being perfectly sharp; the cloud usually enabling us to dispense with the dark glass; and at all times when the disk of *Mercury* was visible the bright ring was conspicuous. My assistant observer, whose eye is both keen and well trained, confirmed me in this.

"We were obliged to use a very low power on account of the clouds. Mr. Pye had a power of 50 on my 3-inch Cooke, whilst I employed rather less on the 4-inch Cooke Equatoreal belonging to the Society."

Mr. G. F. Chambers, at his Observatory, Northfield, Eastbourne, Sussex, writes:—

"About half an hour before sunset the Sun appeared through the clouds for some ten minutes, and I was enabled to get a few glimpses of the planet. I could detect no indications of a spot, but a ring was visible round the planet. The breadth of it was slightly more than the diameter of the planet, but I had no chance of making any measures. My wife, whose vision is very acute, described it as a dark ring, but I am unable to feel quite sure whether it ought to be described as bright or dark.

"I will only add that I used a refracting telescope of 4 inches aperture and a power of 60."

Mr. Cole writes:—

"I send the following notes (for what they are worth) of the ingress, as seen at Sutton (Surrey) by myself and others.

		External Contact. h m s	Internal Contact. h m s
J. J. Cole.	Refractor: Aperture $6\frac{1}{4}''$, reduced to $2''$; diagonal eye-piece.	3 12 0 (estimated from half on limb $13^m\ 15^s$).	3 14 30

		External Contact. h m s	Internal Contact. h m s
R. L. Cole.	Refractor: Aperture $3\frac{1}{4}$ in., reduced to $1\frac{1}{2}$″; image on screen.	3 12 9	3 14 30
A. W. Bawtree ($\frac{1}{3}$ of mile away).	Refractor: Full aperture 3″; image on screen.	3 12 18	3 14 30

"The Sun became nearly clear at $3^h\ 5^m$, and remained so without obvious cloud until $3^h\ 25^m$. After that the planet was not seen on the disk.

"The definition during ingress was very good. There was not any black drop or 'stickiness' between the limb and the planet that I myself could detect. Our time was probably correct to a few seconds."

Mr. Penrose, at Colebyfield, Wimbledon, writes:—

"The sky was very thick until a few minutes before the predicted ingress. Then there seemed some hope of an opening, and a 'ghost' of the Sun appeared. Fearing, however, want of distinctness if I used the reflecting solar eye-piece which I had prepared, I changed it for a direct positive eye-piece magnifying 75. Focus rather roughly got; still, I had a tolerable definition. The sky cleared very much, and towards the time of internal contact the Sun's heat slightly scarred the grey glass screen I was using. The time observations are given on another page. After these were taken I replaced the solar eye-piece, using a magnifying power of 110; and both I and another observer saw a flickering spot of light on the planet's disk. To me it appeared about one-fifth of the planet's diameter above the centre, that is, in the direction of the Sun's centre. I consider it to be an optical effect entirely.

"The definition was good until about 15 min. after ingress, after which nothing could be observed.

	°	′	″	
Latitude	51	24	57	N.
	h	m	s	
Longitude	0	0	55·2	W.

"Tube and object-glass by Steinheil. Mounting and clock by Troughton and Simms.

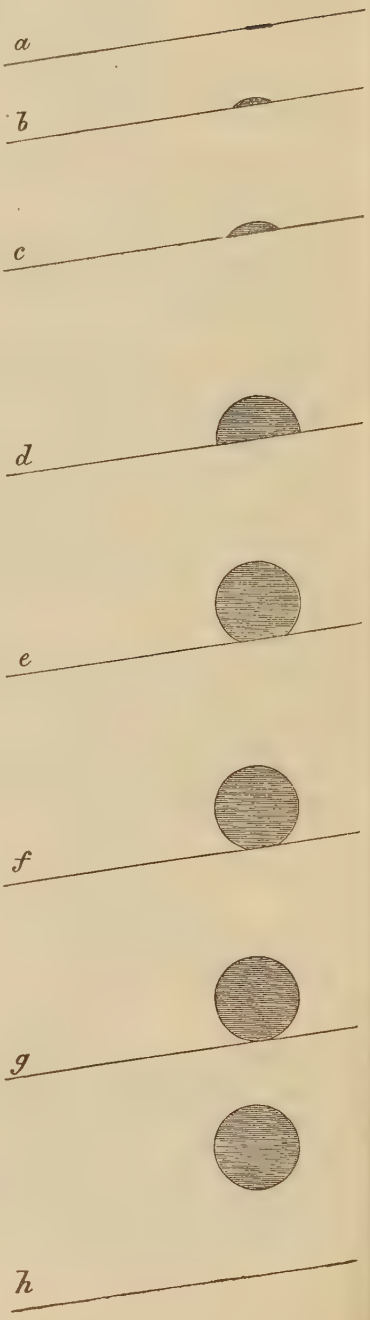
Aperture	$5\frac{1}{4}$ in.
Focal length	83 in.

"Time by a watch compared before and after the observations with a sidereal clock by Aldridge; rate, $+0^s{\cdot}5$ per diem, as ascertained by good meridian observations of stars on the evening of May 4, and of ☿ on the mornings of the 5th and 7th, civil reckoning. Two assistants were engaged in recording the time, one watching the minutes and seconds, the other writing down the times called for.

"The times here given are reduced G.M.T.

May 6, 1878, 3^h +

m	s		
11	3·5	*a*	Suspected dark bar on ⊙'s limb very uncertain; scud ensued for a short time; the trace then lost.
12	4·5	*b*	Strongly defined notch on ⊙'s limb.
12	13·5	*c*	Notch seemed to have doubled its area.
12	49·5	*d*	Apparent bisection of planet.
14	1·5	*e*	The area of the excluded segment seemed equal to that of the notch first seen.
14	31·5	*f*	Planet apparently circular, but clinging to limb.
14	35·5	*g*	Two thin threads of light seemed to stream between ☿ and ⊙'s limb.
17	54·5	*h*	Estimated distance from limb = diameter of planet.



"From phases *b*, *c*, and *e*, I should deduce external contact at about $3^h\ 11^m{\cdot}35$. The phase *d*, making allowance for irradiation, is not inconsistent with this deduction."

Mr. Prince, at his Observatory, Crowborough, Tunbridge Wells, writes :—

"The first gleams of sunshine, since the early morning, occurred at $3^h\ 5^m$, $3^h\ 8^m$, and $3^h\ 10^m$ respectively. At the latter time external contact had *not* happened, and it was most unfortunate that at this moment heavy clouds came up from S.E. and totally obscured the Sun till $5^h\ 49^m$; but from this time till $6^h\ 25^m$ I had the opportunity, during intervals of a few seconds' duration, of noting down the following observations :—

"In the first place I found the atmosphere in such a disturbed and tremulous condition that any micrometrical measures were out of the question. The limb of the planet frequently resembled a slowly revolving cogged wheel. During moments of best definition, with a power of 90 within a Dawes eye-piece, having a half-inch diaphragm and a tinted wedge, a diffused greyish patch was visible *about* the centre of the planet (it was absolutely impossible to estimate its position more precisely, on account of the great atmospheric tremor); but upon changing the power to one of 250 the patch was no longer visible, and the planetary disk was uniformly dark throughout; upon returning, however, to the power of 90 it was again visible. An aureola of light, a little brighter than that of the Sun's disk, surrounded the planet. Its breadth varied from about six seconds when the Sun was partially obscured by drifting scud to about four seconds when it was free from cloud. The periphery of this ring was not well defined; but this, again, might have been due to atmospheric tremor. It had not the slightest trace of colour. My equatoreal telescope, late Dr. Pearson's, and made by the elder Tully (see *Memoirs of Royal Astronomical Society*, Vol. ii., p. 507), is of 6·8 inches aperture and 12 feet focal length. Latitude $51^\circ\ 3'\ 14''$ north; longitude (in time) 38 seconds east."

Prof. Pritchard, at the University Observatory, Oxford, writes :—

"The observations of this phenomenon at Oxford will, I fear, only add another instance to the list of failures in the South of England. A battery of telescopes had been prepared, including a Sun spectroscope attached to the large Grubb refractor, for the purpose of examining the progress of the appulse across the chromosphere; but dense clouds proved fatal to success so far as observation of the ingress was concerned.

"However, about 19 minutes after the commencement of the transit, a few short and partial breaks in the clouds occurred, and during three very short intervals *Mercury* was steadily viewed in the De la Rue reflector of 13 inches aperture. The metallic plane speculum had been removed from the instrument, and its

place supplied by a first surface reflection from a large Herschelian prism. A Dawes eye-piece was attached, with a diaphragm of ·3 inch, power 120, and the result was a calm and beautifully defined image of the planet on the Sun. During two of the glimpses, I entertained no doubt that the centre of the planetary disk was very decidedly brighter than the rest of the planet; but during the third and briefest glimpse I failed to detect the phenomenon. There was no aureola discernible round the limb of the planet. The appearance of conspicuous brightness near the centre was confirmed by Mr. Jenkins, one of our very intelligent assistants; but nevertheless, owing to the brief intervals during which the Sun was even partially unobscured, and the consequent impossibility of making further experiments, I should hesitate to affirm that the bright spot in question originated in actual physical conditions of the planet itself. I may add that the general appearance of the planet on the Sun's disk was by no means so decidedly black as I had anticipated, a remark which also occurred independently to Mr. Jenkins.

"*May* 8, 1878."

Mr. Proctor, observing at Clapham, writes:—

"The weather was altogether unfavourable for observations intended to assist in the interpretation of optical or physical phenomena presented by *Mercury*. About half an hour before ingress the sky was altogether clouded and rain was falling. Shortly after, the Sun could be occasionally seen through haze between the heavier clouds. For a second or two during egress a view was obtained of *Mercury*, rather more than half immersed, but the glimpse was too brief for any peculiarity of figure to be recognised, supposing any then existed. About $3^h\ 21^m$ the sky cleared about the Sun's place, but the aspect of the north-eastern sky showed that the opportunities for observing *Mercury* would be brief and imperfect. At this time I was using a Kellner, power about 120, with the two-prism solar eye-piece and Barlow lens. Later I used, for a very short time, a Browning C eye-piece with the same solar eye-piece. Throughout I used the full aperture (8½ inches) of my Browning-With reflector. At first the weakest darkening glass was required, but later the haze thickened so much that no darkening glass was wanted to protect the eye. During the few moments, however, in which I used the C eye-piece the neutral tint glass was added. Despite considerable motion in the upper air, and apart, of course, from transient effects of haze &c., definition was excellent.

"*Mercury* appeared as a uniformly dark disk, except near the centre, where there was a whitish spot of sensible magnitude, and brightest in the middle. It seemed very nearly as bright there as the general surface of the Sun; but I have no doubt that its apparent brightness was in part due to contrast with the blackness of the disk of *Mercury*.

"I now paid special attention to the bright ring; but I may

as well complete the account of all I was able to notice about the bright point.

"First, it was quite as distinct when the solar image faded in lustre as when that image was brightest. But when any of the small scudding clouds, while darkening the greater part of the solar disk, left the image of *Mercury* unaltered, the spot grew perceptibly fainter. I was not looking for this, and attach therefore the more importance to it. The first time it happened I thought I must have been mistaken; but I afterwards noticed it unmistakably three several times. As the spot recovered its brightness it seemed three-cornered. But the change was too rapid for me to be certain about this; and when the Sun's image was steadily seen no triangularity could be recognised in the spot.

"I could not detect any displacement of the spot from the centre of *Mercury's* disk with the low power employed. Later, when I used the C eye-piece, I only had time to notice that the spot was very much fainter than with the Kellner. I was sliding out the neutral tint graduated glass to observe the spot better, when clouds covered the Sun, which was only seen during two momentary glimpses thereafter.

"I have no doubt whatever that the spot is a merely optical phenomenon. I may note that I could perceive no change in the appearance of the spot when the telescope was released from the driving clock, and *Mercury* allowed to approach the edge of the field.

"Around *Mercury* there seemed to be a ring brighter than the Sun's surface. But I am inclined to suspect that the completeness of this ring is an optical illusion. When I directed my attention to the side of *Mercury* remotest from the Sun's limb, I could not detect any trace of a bright ring, though I could see with perfect distinctness the darkening towards the well-defined limb of the planet. On the other hand, when my attention was directed to the side of *Mercury* nearest to the Sun's limb, the bright ring was very obvious and appeared to surround the whole disk. I feel satisfied that if the half of *Mercury's* disk nearest to the edge had been kept out of view, no bright arc would have been seen round the remaining half, but I had no time to try the experiment. I could detect no trace of colour in the dark part of the ring next to the planet's disk. But the day was very unfavourable for detecting colour. The disk of *Mercury* itself did not appear black, but only of a very dark grey, owing to the bright haze over the Sun.

"The bright ring seemed very fine, a mere thread; but its distance from the limb of *Mercury* was equal to nearly or quite one-third of the planet's diameter.

"Beyond noting that the ring could be well seen with the C eye-piece—more distinctly, in fact, than with the Kellner—I could make no observations on it with the higher power. For I had barely changed powers when the Sun disappeared—about $3^h\ 50^m$.

Capt. Noble communicates the observations made at Antwerp by the Baron von Ertbon, and MM. de Boë and Schleusner.

The weather was favourable, and at the time of interior contact, the limb of the Sun was of an extreme sharpness such as is very rarely seen.

The interior contact was observed by

	h	m	s		h	m	s	
M. de Boë at	3	31	53·5 ⎫ M. T. Observatory of	= 3	14	14·9	G.M.T.
M. von Ertbon	3	31	54·5 ⎭ M. de Boë	= 3	14	15·9	

No black drop nor ligament was seen : the limb of the Sun reappeared without any deformation.

The observation was thus exceptionally good. M. Schleusner was the first to recognise that a brighter aureola surrounded the planet ; and that there was a bright spot on the surface of the planet. The breadth of the aureola was about equal to the radius ; the bright spot had the aspect of the Sun's surface, as if this had been seen through a hole. These observations were confirmed by all the observers, with the different instruments.

β Leonis and B.A.C. 3992. By S. W. Burnham, Esq.

Admiral Smyth, in the *Cycle of Celestial Objects*, has noted a very distant companion to *β Leonis*, giving

$$P = 114 \qquad D = 298''.$$

No star was seen in this place by Powell ; but in the opposite quadrant, about the same distance, he found a star of nearly the same magnitude, which he supposed was the one seen by Smyth, there being an error of 180° in the angle given above. This view is supported by the remark in the *Cycle* concerning a 7 magnitude star in the same direction at a greater distance. There is no bright star anywhere near *β* except the one in the *sp* quadrant, which is B.A.C. 3992.

Mr. George Knott, in his recently published work, gives measures of several stars in the field, including the two above referred to, and a very faint one near the place of Smyth. It is not probable that Smyth referred to this star. It is too minute, and does not answer the description in other respects. Errors of this kind are so common in the *Cycle*, and the stars themselves so unimportant, that it is hardly worth while to follow them up. Mr. Knott's measures of three stars in the field are as follows :—

	P	D	
A and B	206·4°	282·42″	1864·40.
A and E	115·4	303·50	1864·38.
A and D	201·5	1134·3	1864·37.

The last is the 7 magnitude star referred to by Smyth. Looking at *β* with the 18½-inch refractor of the Dearborn Observatory, I noted a star much nearer than any hitherto seen,

but still too distant to be of any importance, unless as a light test. By a single set of measures I found

P = 345°0 D = 76″59 1878·21.

This star is excessively minute, and probably an aperture of at least 12 inches would be required to show it satisfactorily.

The distant large star (D of Mr. Knott's measures) I found to be a fine pair, moderately close, and considerably unequal. From two measures I found

P = 337°7 D = 1″52 1878·21 Mags. 6·7 . . . 11·0.

This is a very easy object with the large aperture.

A much more difficult pair was discovered, $2^m\ 17^s\ p$, and $35'\ n$ of β *Leonis*. The components are close and very unequal. One set of measures gave:

P = 73°4 D = 0″57 1878·15.

This star is Lalande 22262, $7\frac{1}{2}$ magnitude, but more like 8 mag. to me.

Chicago, April 25.

Observations of Polar and Equatoreal Diameter of Mars, near Opposition 1877, *with Equatoreal Instrument*, 8-*in. aperture*, 110 *in. focal length.* By R. L. J. Ellery, Esq.

1877.	No. of Measures.	Eq. Diam. ″	P. Diam. ″	Micrometer.
27 August	8	24·550	24·185	Double-image micrometer; power 2.
29 August	10	25·488	24·918	D.-I. microm.; power 2.
30 August	20	25·082	25·172	D.-I. microm.; power 3.
6 September	10	26·806	26·171	Parallel-wire micrometer; Barlow lens, power 262.
	20	25·287	25·602	D.-I. microm.; power 3.
	10	25·268	24·747	D.-I. microm.; power 2.
16 September	12	24·137	24·484	D.-I. microm.; power 3.
17 September	20	24·046	23·688	D.-I. microm.; power 2.
22 September	20	22·772	22·947	D.-I. microm.; power 2.
26 September	10	22·248	22·230	D.-I. microm.; power 2.

N.B. The Airy double-image micrometer is supplied with four power lenses, No. 1 being the highest; the *power*, therefore, as spoken of above must be understood to be the power lens used, not the magnifying power.

The measures are not corrected for defect of illumination.

Observatory, Melbourne,
February 21, 1878.

On a Solar Photograph. By Dr. L. M. Rutherford.

Dr. Rutherford writes :—

"Permit me to present to the Society a copy on glass taken from a negative of the Sun made at my Observatory on August 11, 1871. It represents a small portion of the Sun's disk with one spot, and a group of smaller ones; but it is not to these features which I desire to draw attention. Shortly before leaving America I saw a copy of the magnificent photograph of the Sun made by M. Janssen and read his communication on the subject in the *Comptes Rendus*. In this he says that his are the first and only photographs which represent the granulations of the Sun's surface. I do not claim that my photograph of 1871 is at all equal to that of M. Janssen; but I submit it simply as a correction to the history of this part of astronomy. It will be seen on inspection with a proper lens that the granulations, rice grains, or willow leaves are quite fairly visible on the copy presented.

"It was made with my 13-inch achromatic corrected for photography by the attachment of a correcting meniscus of flint glass, and with a very short exposure, the duration of which I have never measured.

"*London, May* 10, 1878."

Notes of some Errata in the Report of the Progress of Meteoric Astronomy during the year 1877. By Professor A. S. Herschel.

A few typographical and other errors present themselves in the "Report of the Council on the Progress of Meteoric Astronomy during the year 1877" (in this volume, p. 216, *et seq.*), the following proper corrections of which I am able, by some recently received information, to supply.

P. 229, in the table, column end-height, of the detonating fireball seen in the United States on Nov. 20, 1877, for "a little S.E. of," read "a little S. of E."

P. 231, line 24 from bottom of the page, for "Aug. 16," read "Aug. 17."

Professor D. Kirkwood informs me that the fall of an aërolite stated (p. 219, in the note) to have occurred in Georgia, U.S., on Jan. 20, 1877, proved on investigations which he made, to be a newspaper invention, no such occurrence as that of an aërolitic fall on the asserted date having really taken place.

The radiant point near *a Ceti*, noticed (p. 226) as having been observed by Mr. E. F. Sawyer, at Boston, U.S., on October 17, 18, and 20, 1876, Mr. Denning regards as being very imperfectly determined (see *Astronomical Register* for 1878, p. 106), as in a tracing of them with which he was furnished by Mr. Sawyer the courses of the meteors seen began near that star, and were for a position so near the radiant point too long to be probably conformable to the centre of divergence there which was assigned to them.